Resource-Extraction Employment Proportions and Socioeconomic Indicators in Canadian Municipalities

A Thesis Submitted to the Department of Geography

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Abstract

The purpose of this study was twofold: 1) to describe the distribution of mining employment in Canada by proportion within census subdivision boundaries (CSD), and 2) to describe mining employment in relation to various socioeconomic indicators at the CSD level. This was accomplished by stratifying mining employment proportions into individual categories (none, low, medium, high, and extreme) and calculating the median values of each of these indicators according to mining employment proportion. In effect, communities were profiled according to their level of reliance on resource-extraction dependency. In order to adequately contextualize these findings, a large body of socioeconomic and resource community-based research literature was drawn from. These examples provided a foundational basis for the interpretation and conclusions reached in this study.

Acknowledgments

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1.0 Introduction

Mining and resource extraction is among Canada's most robust industries, employing over 380,000 individuals in the extraction, smelting, fabrication, and manufacturing of Earth materials and its by-products (Mining Association of Canada 2016, p.16). It contributed some 56 billion dollars towards the national gross domestic product in 2015, and accounted for 19% of total exported goods during the same year (Mining Association of Canada and Marshall 2016). Thus, it may come as no surprise that Canada is among the world's top destinations for mineral exploration (Mining Association of Canada and Marshall 2016, p.7). Similarly, the oil and gas industry contribute significantly to employment and the wealth of the Canadian economy, employing over 210,000 persons as of 2015 (Statistics Canada Government of Canada 2016). Thus, together these industries account for the employment of well over half of a million Canadians. With so many communities carrying significant proportions of employment within resource-extraction sectors, it seems reasonable to conclude that many of Canada's community-level socioeconomic profiles are heavily influenced by these professions, most likely by means of a combination of work-lifestyle culture inherent to this employment type, and socioeconomic 'signatures' unique to resource economies. In light of this, it was decidedly important to attempt to characterize Canada's communities by proportion of mining employment, and how these differing proportions influence socioeconomic indicators. In effect, this study represents an attempt to 'profile' the mining communities of Canada. It also served to describe the distribution of mining employment throughout the country on a regional basis. It was anticipated that by doing so, a generalized effect on communities that mining imparts

could be described in order to support the description of social and economic-driven research in Canada and perhaps beyond.

2.0 Literature Review

In order to adequately describe the quantitative results of this study, it was deemed necessary to investigate the literature for descriptions of what constitutes a ‘mining’ economy from the perspective of previous research efforts. While it was attempted to place emphasis on Canadian examples, some of the literature described below was based on research conducted internationally. However, these examples were cited only when thought to be relevant to the contextual foundation of this study. All of the examples explored were deemed to be useful as supplementary information for the analysis and observation portions of this research, though most of the available literature seemed to focus on qualitative finding rather than quantitative variables, such as what is described in this research (median house value, median age, unemployment rate, etc).

Strangleman (2001) describes the typical coal-mining towns of the Southern UK as being culturally “homogenous”, characterized by a paternalistic and aristocratic working population whose social life and work habits act as nearly a single unit. He describes a certain ‘transient’ attitude among the workers and population with regards to these communities, in response to the state of frequent migration among the residents following the inevitable depletion of local mining resources. Several interviews among former and current residents of various coal-mining towns prompted Strangleman to assert that the populations of these communities tended to take upon a greater reliance

on immediate kin than those of more diversified economic backgrounds. Emphasis was placed on the phenomenon of mining employment being closely associated with the "forging of young male identity". The atmosphere of urgency Strangleman sets in his writing is reminiscent of how economic geography has been described in relation to 'staple' communities, to which Canada has long been associated with from the perspective of historical writers. Hayter and Barnes (1950) have written "once a region specializes in producing staples, it then finds it very difficult to reconfigure production into other types of sectors. The result is extreme susceptibility to already volatile resources prices, making the staples economy especially prone to crisis" (p.158).

Bray and Thomson (1996) characterize a sort of familial and community-based employment-life culture attached to mining towns, however, in this case within the context of Northern Ontario communities. It was noted that many communities of Northern Ontario seem to carry a misconception of being more resource-dependent than they contemporarily are. The authors stressed an urgency to cease the stereotyping of Northern Ontario towns as 'frontier' locales. Bray and Thomson (1996) describe a general feeling of 'carryover' ignorance towards Northern Ontario populations, citing a perceived issue of the outside population's tendency to characterize these communities as "problems to be fixed, rather than complex communities to be understood" (p.12). Another relevant discussion point was the concept of 'cabin fever' associated with remotely-situated towns. It was asserted that, the concept of 'cabin fever' is too vaguely described, and that sociological literature indicates that virtually any locale faces some sort of categorical form of isolation, and that is not a phenomenon overall unique to Ontario's North. It is also stressed that by far

most locals do not take up lifestyles seen stereotypically as ‘Northern’ in the minds of more Southern communities, and that Northern Ontario towns are now primarily urban in landscape and economy. So, while the literature seems to align with the previously stated relationship between mining or single-industry origins as deriving familial and tight-knit communities, it is suggested that, at least in the case of Northern Ontario, these traits do not always transcend economic growth into categorically ‘urban’ and ‘diverse’ locations. At the very least, these communities may share certain traits born of common industries, but experience stereotyping out of scale with contemporary realities.

Randall and Ironside (1996) shared a similar point of view that the literature has for too long inaccurately indicated that primary-resource dominated towns suffer from predictable social characteristics, and insufficient attention is given to how non-resource industries present in these communities also help to shape their overall character. Randall and Ironside indicate that one benefit to the incidence of supposed isolated resource-based communities was that, regionally speaking, it was possible for community residents to benefit from resource interdependence of other ‘nearby’ resource communities in employment terms, as if the greater region as a whole served as a sort of “dispersed city” (Norris, 1986). However, the authors also acknowledged that certain historical trends associated with single-industry towns appear to persist into the present, including relative isolation (median distance to a CMA is ~300km) and the low proportion of females employed in resource sectors.

Wilson (2004) wrote that the experience of mining communities can be metaphorically compared to a that of a rollercoaster’s in that, longitudinally speaking,

the experience of living in a ‘mining town’ sees fluctuations much in the same way a rollercoaster experiences fluctuations in shape, speed, height, and length. She draws attention to the fact that the socioeconomic conditions of these towns are often thought of as improved over time, given that economic diversification is considered imminent to the survival of a mining town which would otherwise inevitably experience death. However, she notes that in the experience of her case study between various mining towns of the Midwestern United States, some inevitably experience an overall decline in the quality of these conditions. Wilson (2004) describes a certain regional-based community perspective associated with mining communities across broader geographic areas. For example, Doe Run Mine was associated with a high commuter rate from employees living in other counties and communities, thus, the economic boom/bust periods had a comparatively moderated effect on these employees next to mining operations whose bulk of employees resided in their corresponding communities. Though none of these were considered technically diversified locales, the concept of regional ‘banding’ seemed to protect them from serious bust implications at times.

Paradoxically, Goldenberg et al. (2010) have hypothesized that mining economies do not exist in a state of perpetual bliss so long as the community is experiencing a ‘boom’ period. Following an investigation of an oil and gas industry-dominated town, Fort Saint John, British Columbia, the authors concluded that the boom has exacerbated infrastructure, caused significant growth in alcohol and drug consumption, and has severely skewed the male/female ratio of the town due to the influx of young males arriving for competitively paying labour-oriented jobs. Their study also found that the high cost of living in Fort Saint John coupled with the prospect of high incomes

prompt students to leave school at an early age and begin working within the industry. This was surmised to be related to the region's lowest rate of secondary school graduation in the entire province, with 37.3% of individuals not graduating between 2004 to 2006, compared to 23.2% province-wide (p.160). The phenomenon of low secondary school graduation rates in Fort Saint John is compounded by the fact that a high school diploma is not necessary for work in the field.

Shandro et al. (2011) state that mining communities are often characterized by their populations' state of health during boom/bust cycles. From the analysis of an isolated coal-mining town in Northern BC, Tumbler Ridge, the authors illustrate how these cycles lend themselves to certain disease incidence. Notably, that during boom cycles, pregnancies, sexually-transmitted infections, and work-related injuries increase while anxiety and depression are heightened during recession periods. The study was qualitative in nature and relied on personal accounts of the population with regards to impact on mental and physical health. Most all participants cited family life as being the most important aspect to the overall health of the community. Familial issues were said to be heightened at peak boom periods, where increased working hours contributed to family tensions, and during bust periods when incomes were bleak. Additionally, the overall health and employability of women in Tumbler Ridge was considered unsatisfactory, and the population struggled with alcohol and drug abuse. In part of high variability of health status pertaining to this particular population, medical and counselling service resources were found to be stretched beyond their limit. Certainly, these concerns represent variability that is considered imperceptible to the data-driven socioeconomic constructs of this study, but still represent qualitative variables worth

further investigation. This is especially true in the question of women employment proportion, which has proven to be a reoccurring theme in the literature investigated.

Another element of worthy consideration when describing mining communities are the factors that shape the work-lifestyle conditions of their employees in the first place, especially ethnic and social groups who face certain alienation through geographic isolation and the small economies associated with them. In a report published by the Frasier Institute, “Opportunities for First Nation Prosperity Through Oil and Gas Development”, Bains (2013) outlines the value of taking proactive measures to hire greater proportions of First Nations individuals in resource-dependent jobs. Notably, she outlines that the median age for aboriginals in 2011 was 26 years, as compared to 41 years for non-aboriginal Canadians, representing an “up-and-coming” population of largely unemployed persons (~23%) who will benefit greatly from new oil and gas infrastructure project (p.iii). What’s more is that unemployment among FN groups is especially high in regions coinciding major oil and gas projects (20-42%), and that each oil and gas project site shares territory with at least one FN group (p.iii). Thus, much can be done to encourage the employment of persons belonging to these groups for the purpose of decreasing unemployment rate and improving social conditions to their respective communities. Less than half of FN groups graduate high-school and this is typically a requirement for employment within the oil and gas sector. Bains cites new policies aimed at increasing high-school graduation rates as a crucial factor for the employability of these groups, lest FN communities remain a largely untapped localized labour force. “Duty to consult” remains another important factor in the employability of local FN groups. Without the formation of positive relationships and mutual agreement,

the potential to alienate and compound the problem associated with FN unemployment persists. Bains points to section 35 of the Canadian Constitution, stating that governments have a “common law duty to consult, and, where appropriate, accommodate when Crown conduct may adversely impact established or potential Aboriginal and Treaty rights” (p.11).

Archibald and Ritter (2001) discussed the changing role of what constitutes a ‘mining community’ in “Canada: From Fly-In, Fly-Out to Mega Metropolis. Large Mines and the Community: Socioeconomic and Environmental Effects in Latin America, Canada, and Spain”. He compared the positive impacts of mining on Canada’s economic wealth with the negative impacts associated with environmental and social issues imparted by historically ‘irresponsible’ resource-related projects across the country. He attempted to outline some of these issues as ‘guidelines’ that may serve to aid in the mining industry currently experiencing rapid growth in Latin America. He placed heavy emphasis on using the wealth extracted from resource operations to improve nearby associated and affected communities, rather than to benefit mining companies more or less exclusively. He describes several categories of ‘mining communities’ (i.e. fly-in/fly-out, mining metropolises, single-resource towns, etc.) and how these are affected by their industry and what can be done to improve their overall social health. A notable example was the pre-emptive social and environmental plan of the Diavik Mining Company in the Northwest Territories. The Canadian Environmental Assessment Agency (CEAA) required Diavik to undertake an environmental and social assessment report before moving forward with the project. It produced a number of policies that positively influenced nearby communities which have largely consisted of

economically-repressed aboriginal groups. Diavik vowed to eventually increase employment to 100% ‘Northerners’ during the development of the project, with nearby aboriginal groups taking absolute employment precedence (p.241). Furthermore, measures were taken to protect influence on local culture, establish ‘fair’ fly-in/fly-out policies when necessary, and to adequately employ women. After carrying out an environmental impacts investigation suggesting no significant major impact to local air particulate, bio-diversities, and watersheds, Diavik also proposed to set aside $46 million dollars in environmental clean-up and monitoring measures following the mine’s eventual closure (p.245).

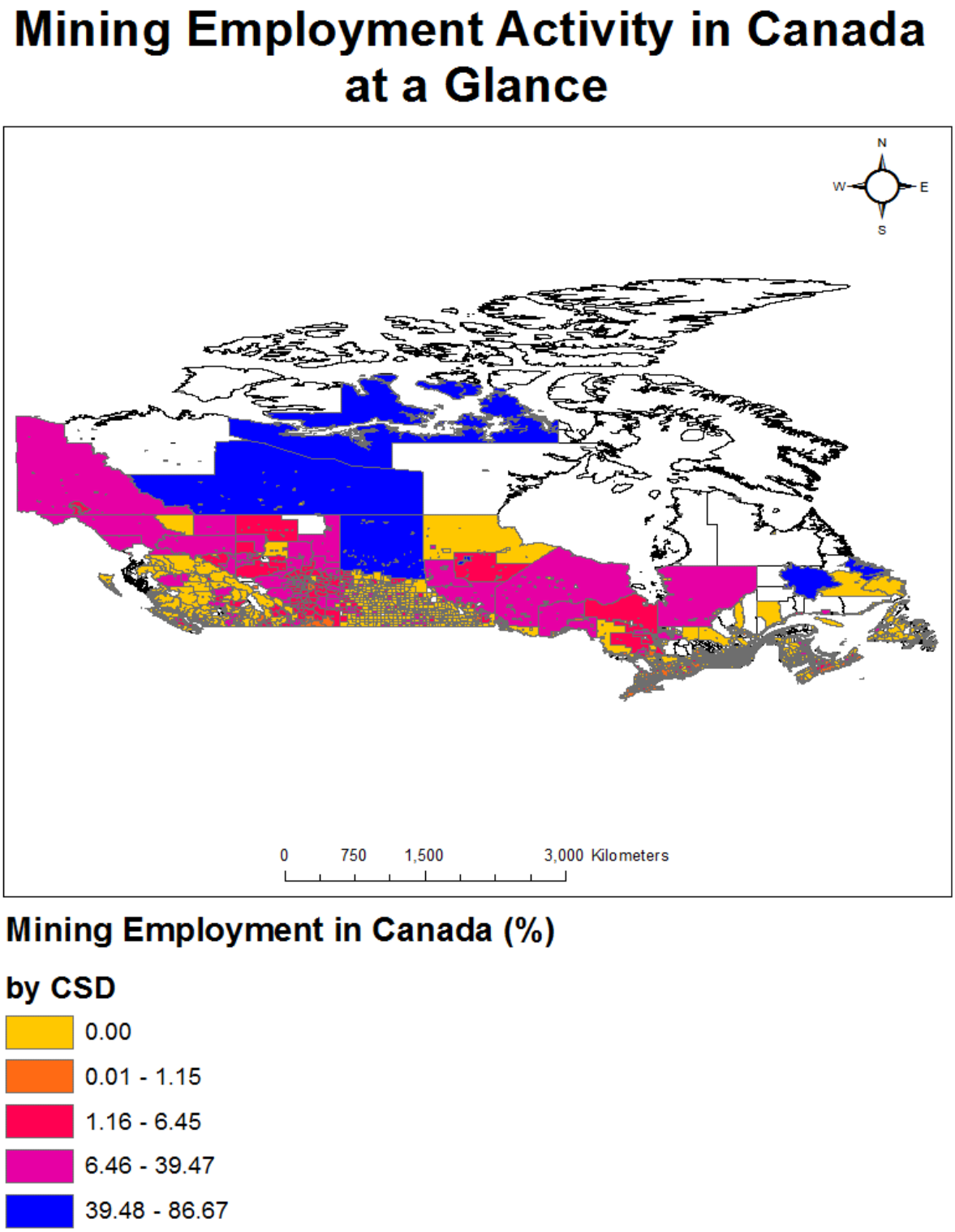
Perhaps one of Canada’s greatest assets in being resource-rich is its tendency to avoid the pitfalls associated with the so-called ‘resource curse’. It is indicated that economies with significant resource-based wealth tend to perform worse in a variety of social and economic measures compared to countries with poor resource reserves (Pegg, 2006). Though the potential to use this wealth to lift these countries in to positions of affluence exists, the direction of funds appears to be grossly mismanaged, resulting in wealth inequalities and relatively poor living conditions for civilians (Pegg 2006). However, in the context of Canada, mining economies are associated with affluence when they are present in either very diversified communities or single-resource dependent communities. Perhaps this indicates the existence of overall satisfactory policies that benefit the resource-based employees, and not exclusively the profitability of mining companies and corrupt governments themselves. This is especially reflected in the trend of increasing mining employment correlating with increasing median income. In fact, Pegg cites that the examples of Canada, Australia,

and the United States represent, historically-speaking, role models for overall positive and responsible national development via extraction economies.

3.0 Methodology

In this study, it was necessary to produce a number of regional maps in order to analyze the spatial distribution of individual CSDs with their corresponding proportions of mining and resource extraction-related employment. These maps were partitioned into three individual groups: ‘binary’, ‘medium’, and ‘extreme’ mining categories. The first category,’ binary’, served to compare census subdivisions (CSDs) with any amount of mining employment against CSDs with no measurable proportion of mining employment. This served to distinguish ‘mining communities’ from ‘non-mining communities’, but not quantify the difference in mining employment proportions within the ‘mining community’ category itself. The ‘medium’ category stratified the majority of mining communities from the dataset according to ‘low’ (0.02% - 1.15%), ‘moderate’ (1.16% - 6.45%), and ‘high’ (6.46% - 39.47%) mining employment activity. The final ‘extreme’ (42.35% - 86.67%) category segregated communities with the highest proportion of mining employment found in the entire country, deemed to be anomalies worth investigating in a separate category. For the final part of the study, a table was constructed outlining the median values of various socioeconomic variables corresponding to the mining categories described above.

Figure 1:


Mining Employment Activity in Canada at a Glance
N
W
E
S
0
750
1,500
3,000 Kilometers
Mining Employment in Canada (%)
by CSD
0.00
0.01 - 1.15
1.16 - 6.45
6.46 - 39.47
39.48 - 86.67

3.1 Datasets

The nationwide scope of this study required the use of Geographic Information Systems to 1) store the data necessary to accurately describe the socioeconomic variations associated with different proportions of mining employment in Canada, and 2) to provide an aesthetically-pleasing means of illustrating the distribution of mining-related employment throughout Canada for analysis purposes. Thus, it was necessary to locate variables that serve to describe the lifestyles of the Canadian population, and physical political boundaries to serve as a basis for a sense of place in overlaying the corresponding data upon.

The Statistics Canada website was used to obtain census data that served to describe the socioeconomic population makeup of Canada. Statistics Canada also stores boundary shapefiles for use in ArcGIS software.

This study deemed census subdivisions (CSDs) to be the political category most appropriate for describing individual communities (mining or otherwise), and thus the corresponding files were downloaded from the Statistics Canada website and imported into ArcGIS. Census metropolitan areas (CMAs) serve in visually ‘landmarking’ the output maps, and were also downloaded and imported into ArcGIS.

Data from the 2006 census program was selected to represent population characteristics. Unfortunately, the 2011 census had few variables of use to this study.

Table 1 illustrates the socioeconomic categories constructed using data from the 2006 Canadian census program (Government of Canada 2001).

Table 1:

Socioeconomic Category	Table 1: Canadian Census Program Data Tables Used
Median Age	Age (123) and Sex (3) for the Population (Catalogue ID: 97-551-Z2006011)
Median Income	Employment Income Groups (14), Age Groups (9) and Sex (3) for Employed Labour Force 15 Years and Over Having a Usual Place of Work or Working at Home (Catalogue ID: 97-561-X2006014)
Median House Value	Value of Dwelling (14), Structural Type of Dwelling (10) and Number of Bedrooms (6) for the Owner-occupied Non-farm, Non-reserve Private Dwellings (Catalogue ID: 97-554-X2006043)
Unemployment (%)	Employment Income Groups (14), Age Groups (9) and Sex (3) for Employed Labour Force 15 Years and Over Having a Usual Place of Work or Working at Home (Catalogue ID: 97-561-X2006014)
Foreign-Born Population (%)	Ethnic Origin (247), Generation Status (4), Single and Multiple Ethnic Origin Responses (3), and Sex (3) for the Population 15 Years ad Over (Catalogue ID: 97-562-X2006015)
Post-Sec Education (%)	Attendance at School (3), Highest Certificate, Diploma or Degree (13), Age Groups (10A) and Sex (3) for the Population 15 Years and Over (Catalogue ID: 97-560-X2006033)
Mining Employment (%)	Industry – North American Industry Classification System 2002 (21), Occupation – National Occupation Classification for Statistics 2006 (11), Work Activity in 2005 (4) ad Sex (3) for the Employed Labour Force 15 Years and Over Having a Usual Place of Work or Working at Home of Canada, Provinces, Territories, Census Divisions and Census Subdivisions of Work, 2006 Census – 20 % Sample Data (Catalogue ID: 96-561-XCB2006007)
Population Change (2001-2006)	• Age (123) and Sex (3) for the Population (Catalogue ID: 97-551-X2006011) • Age (122) and Sex (3) for Population (Catalogue ID: 95F0300XCB2001006)

It was necessary to manipulate each of the census data tables from Statistics Canada in the Beyond 20/20 software package so that each table was organized exclusively by CSD in the primary column. This was to ensure accurate geocoding to

CSD polygon boundaries at the moment of data import. Likewise, unnecessary or unwanted columns of data were deleted so that only relevant information was imported into ArcGIS. While median age, median house value, and median income were available directly from the downloaded tables on the Statistics Canada archives, it was necessary to calculate percentages or interval scales from multiple columns from the original data tables in the SPSS software package. This was done with a simple 'compute' operation, wherein relevant tables were multiplied or subtracted from one another to produce the final socioeconomic categories as a separate table column.

In the case of Post-Secondary Education, all university degrees, college diplomas, and certificates were used in summation to produce a percentage against the total CSD population. Population Change was computed in SPSS through subtracting total population of 2006 from total population of 2001, and dividing by the total population of 2006.

Each modified table was 'saved' as a database file (.dbf) within either Beyond 20/20 or SPSS and imported into ArcGIS. Through a series of 'join' operations, each table was eventually merged into a single shapefile, combining the data associated with each of the eight socioeconomic factors into a single attribute file.

From the sum of the data in a single attribute file (a total of 3900 cases), new layers were constructed using the 'Select by Attributes' feature to segregate the data into several subcategories. These corresponded to 'no mining', 'medium mining', and 'extreme mining'. As previously outlined, the 'medium' category was stratified into intervals of low, moderate, and high according to statistical quartiles, modified further to stratify only three intervals: 0.02%-1.15% (low), 1.16%-6.45% (moderate), and 6.46%-

39.47% (high). This category represented 928 cases, and 333, 333, and 328 cases respectively, if divided by the low, moderate, and high subcategories.

The ‘extreme’ category’ was designed to separate any CSDs with a population employed in mining or resource extraction operations of greater than or equal to 40% as its own map layer. This resulted in 30 cases with a proportion ranging from 42.35%-86.67%. Please see the attached map appendix for each categorical regional map.

The final part of the study consisted of producing a table illustrating the median values of each of the eight socioeconomic variables corresponding to the ‘none’, low’, ‘moderate’, ‘high’, ‘extreme’, and ‘overall’ mining employment categories. This served to describe the impact that different proportions of mining-based communities may impart on their economic makeup. It was constructed by importing the corresponding .dbf files of each mining employment category into Microsoft Excel. A median value for each relevant column was computed and added into a new table on a blank Word document. This was repeated until each mining employment category and each of its corresponding socioeconomic factors were completely computed.

It is worth acknowledging that during the construction of this table, some generalized assumptions were made with regards to ‘0’ values. In all of cases, ‘0’ values were discarded from the calculation of medians used for the table described above. This was done under the assumption that ‘0’ under median income, median age, median house value, unemployment % is a virtually impossible result and must indicate a lack of recorded data for the corresponding CSD, rather than a true ‘0’ value. True ‘0’ values under post-secondary education % and foreign-born % were assumed to be extremely unlikely results, and were also discarded. Finally, following similar logic, values of -99%

computed for use under population change were deemed to be incredibly unlikely, and these were also eliminated from the median calculation. It was decidedly more sensible to risk slight, but improbable inaccuracies within the calculations than to include a significant number of false zeros, which would serve to skew the median results much more. Table .2 illustrates the median calculations

4.0 Observations

The combination of regional output maps and table illustrating socioeconomic medians yield a number of meaningful and surprising results within the study. With thousands of individual CSDs cases being represented, it is believed that the calculated socioeconomic medians are quite indicative of the mining proportions that represent them. Likewise, the distribution of mining employment solely by CSD reveal a number of interesting distribution patterns. Therefore, the reported results provide a reasonable account of the characteristics of these communities. Below, a summary of these findings are organized according to Canadian regions. For each given region, please see the corresponding distribution maps in the Appendix of Maps.

4.1 The Maritime Provinces

All CMAs associated with the maritime provinces were found to have at least some CSDs corresponding with direct mining employment. Halifax, NS as a whole has 0.31% mining employment (‘low’ category). Within the St. John, NB CMA, Hampton CSD was associated with 6.38% mining employment (‘moderate’), and St John CSD retained 0.31% (‘low’). Moncton CMA contained Elgin CSD with 7.14% (‘high’), Moncton (2.18%, ‘moderate’), Moncton-Dieppe (1.11%, ‘low’), and St. Paul (14.29%, ‘high’). In St

John's, NFLD CMA, Conception Bay South CSD retained a 0.6% mining employment population ('low'), St. John's retained 1.98% ('moderate'), Mount Pearl (3.01%, 'moderate'), Torbay (1.48% 'moderate'), and Logy Bay-Middle Cove-Outer Cove (6.06%, 'moderate').

Six of the thirty total cases of 'extreme' mining CSDs are present in the Maritimes region of Canada. Two in New Brunswick, and four in Newfoundland and Labrador. Remarkably, Cardwell CSD, NB (42.35%) is located adjacent to Moncton's CMA region. Wabush, NFLD, an iron-ore-based community in the extreme Northwestern portion of Labrador, is one of the CSDs with the highest proportions of mining employment (76.57%) in the entire study (Natural Resources Canada 2016).

In general, the Maritimes' mining population activity distribution seems to concentrate around coastal locations, coinciding with the general population centers of the region, and may also be related to Newfoundland and Labrador's oil and gas exploration as well (Canadian Association of Petroleum Producers 2010).

4.2 Central Canada

The provinces of Ontario and Quebec constitute the Central Canadian region for the purposes of this study. Not surprisingly, the distribution of CSDs with the highest to lowest proportions of mining employment tend to show a strong North-South graduated progression. That is to say regions with the highest percentage values tend to be located further North in either province, with the Southern Ontario-Quebec corridor retaining CSDs with the lowest values. However, a surprising amount of consistent low-concentration mining employment is located in the Southern portion of the region, especially within Southern Ontario. This activity is attributed to the extraction of non-

metallic minerals such as salt, gypsum, lime, and structural materials such as sand, gravel, and stone which serve as a basis for aggregate materials useful to basic infrastructure operations (Government of Ontario 2012). The majority of these CSDs retain specifically ‘low’ category (0.02%-1.15%) mining employment proportions, however Southern Quebec experiences a relatively small smattering of ‘medium’ and ‘high’ category CSD incidences within and around the CMAs of Montreal, Quebec City, and Sherbrooke. This general distribution tends to taper out along the coastal regions of the St. Lawrence river.

The ‘extreme’ values of Central Canada have a less ‘intuitive’ distribution compared with those described above. Manitoulin, Unorganized, West Part CSD represents the only existing ‘extreme’ case in all of Ontario, with a 44.35% mining employment proportion. This outlier is explainable through a nearby dolomite quarry operation used to produce aggregate materials, operated through the French industrial company, Lafarge (Lafarge 2015).

In Quebec, Havelock CSD is situated on the Canada-USA border a mere twenty kilometres from the furthest extent of the Montreal CMA. It retains a 47.92% mining employment proportion and represents one of the furthest Southern incidences of ‘extreme’ mining proportion CSDs in the entire study. Preissac CSD is situated adjacent to Rouyn-Noranda CSD (8.51%, ‘high’), an established and populous copper-mining community. Surprisingly, Preissac retains a 67.82% mining employment proportion, suggesting that it perhaps houses a large proportion of employees working for the nearby Glencore-owned copper mine within Rouyn-Noranda CSD (Glencore 2017).

4.3 Central Prairies Region

The Prairies region in this study incorporates Manitoba and Saskatchewan only. In contrast to the Central Canada region, CSDs within the prairie provinces do not appear to follow any high to low proportion progression on a north-south axis. The distribution is comparatively random. Furthermore, of 204 total 'mining CSDs', only 28 are of the 'low' proportion category. Therefore, CSDs in the Prairies Region with any mining proportion at all are overwhelmingly classified as 'moderate' or 'high' proportion mining communities. The highest proportion of mining CSDs fall under the 'high' stratification category contained 98 cases, with 68 belonging to the 'moderate' category. The 10 'extreme' category cases occur exclusively in Saskatchewan.

Perhaps the most notable anomaly for the Prairies Region is Colonsay No. 342 CSD belonging to the Saskatoon CMA. It retains 59.62% mining employment, making it the single highest mining employment proportion CSD in the entire study to be situated within a CMA's boundaries.

All CMAs within the Prairies Region contain at least some CSDs with a mining population. Overall, Winnipeg has the lowest with three CSDs scoring in the 'low' category: Springfield (0.44%), Winnipeg (0.05%), and Tache (0.69%). Regina has one CSD under the 'low' category (Regina, 0.32%), one under the 'moderate' category (Pilot Butte, 2.44%), and one under the 'high' category (Pense No. 160, 35.82%). Saskatoon CMA has two CSDs within the 'low' category: Saskatoon (0.93%), and Warman (0.96%). Three CSDs scored under the 'moderate' category: Delisle (3.33%), Dalmeny (3.92%), and Dundurn (0.4.35%). Six CSDs are under the 'high' category: Martensville (6.53%), Corman Park No. 344 (6.94%), Allan (20%), Vanscoy No. 345 (31.2%),

Blucher No. 343 (32.86%), and Colonsay (36.67%). As previously stated, Saskatoon CMA also has one CSD within the ‘extreme’ category, Colonsay No. 342 (59.62%).

The relatively high incidence of mining employment in certain CSDs within the Prairies Region is primarily attributable to the wealth of potash, oil, and uranium reserves throughout Saskatchewan and Manitoba (Natural Resources Canada Government of Canada 2016).

4.4 Far-Western Canada

The provinces of British Columbia and Alberta constitute the Western Canada region of this study. Due in part to its substantial role in the oil and gas production industry, Alberta was analyzed separately from British Columbia to account for its significant role in mining and resource extraction compared to other Canadian provinces. To generalize the distribution of mining employment of this region as a single entity would be less desirable.

4.4.1 Alberta

Alberta is the only Canadian province to retain an extreme minority of CSDs with no population employed in the mining and resource sector whatsoever. This is well-illustrated in the binary map of the Western Canada region (see “Map Appendix”). Of the 226 mining employment CSDs (317 total CSDs in Alberta), 21 cases are associated with the ‘low’ category, 95 cases are ‘moderate’, 107 cases are ‘high’, and 1 case is ‘extreme’. The few ‘low’ category CSDs tend to cluster to the South of the province, or are adjacent to the Edmonton CMA. The ‘moderate’ and ‘high’ categories are dispersed throughout the remainder of the province, while the single ‘extreme’ CSD of Halkirk

(58.33%) representing less than a square kilometre of area, is located in the Central-Eastern extreme of the province.

Within Edmonton CMA, one CSD (St. Albert, 0.73%) retains a mining employment proportion corresponding with the ‘low’ category. 12 CSDs retained values corresponding with the ‘moderate’ category: Edmonton (1.25%), Stony Plain (178%), Spruce Grove (1.8%), Beaumont (1.81%), Gibbons (1.83%), Morinville (2.52%), Sturgeon County (3.42%), Fort Saskatchewan (4.52%), Devon (4.92%), Strathcona County (5.37%), Thorsby (6.19%), and Bruderheim (6.38%). Nine CSDs retained values corresponding to the ‘high’ range: Leduc (6.7%), Calmar (7.14%), Bon Accord (9.62%), Redwater (10.38%), Parkland County (10.66%), Wabamun (17.95%), Leduc County (18.89%), Warburg (22.22%), and Seba Beach (33.33%). Calgary CMA contained six CSDs with values corresponding to the ‘moderate’ category: Cochrane (2.48%), Chestermere (2.53%), Airdrie (2.58%), Rocky View No. 44 (4.28%), Beiseker (4.35%), and Crossfield (4.95%). Calgary CSD (7.12%) is the only CSD to retain a proportion of mining employment corresponding to the ‘high’ category. Similar to the province as a whole, both CMAs represent microcosms, with the overwhelming majority of CSDs within themselves containing at least some mining employment.

4.4.2 British Columbia

In contrast to Alberta, British Columbia has fewer CSDs with mining employment. CSDs with the highest proportions of mining employment tend to be situated outside of the province’s CMAs, while the lowest proportions typically occur within the CMAs. There also exists a cluster of exclusively ‘high’ value CMAs in the most northerly extent of the province. Interestingly, the four cases of ‘extreme’ values occur within the

Southern portion of the province. Within the Vancouver CMA, Fraser Valley H CSD retains a 50% mining employment proportion. Sparwood (45.62%), Elkford (68.16%), and Logan Lake (73.85%) constitute the additional cases.

Kelowna CMA contains three CSDs with a mining employment population, each of which retained values consistent with the ‘low’ category: Kelowna (0.22%), Central Okanagan J (0.26%), and Lake Country (0.4%). Vancouver CMA contained 16 CSDs with values corresponding to the ‘low’ category: West Vancouver (0.06%), Greater Vancouver A (0.06%), Delta (0.1%), Richmond (0.13%), Burnaby (0.13%), Langley 1 (0.13%), Surrey (0.19%), Mission (0.22%), Pitt Meadows (0.23%), White Rock (0.25%), Langley 2 (0.25%), North Vancouver (0.34%), Abbotsford (0.35%), Coquitlam (0.38%), and Vancouver (0.7%). Port Moody (1.62%) is the only ‘moderate’ category CSD while Belcarra (11.11%) was the only ‘high’ category CSD. Fraser Valley CSD (50%) is the only ‘extreme’ category CSD. Victoria CMA retained 7 CSDs with values corresponding to the ‘low’ mining employment proportion: Saanich (0.09%), Esquimalt (0.1%), Central Saanich (0.13%), Oak Bay (0.14%), Langford (0.14%), Sidney (0.18%), and Sooke (0.45%). Colwood (2.03%) is the only other CSD to retain a value beyond the ‘low’ category (‘moderate’).

4.5 Northern Canada

The region of Northern Canada includes the three territories of Nunavut, Northwest Territories, and Yukon. Of the 70 total CSDs that comprise this spatially vast region, 21 CSDs have a population with at least some proportion in mining employment. There is a strong tendency for these CSDs to occur in the more Western regions of the country, and in particular the Yukon territory. This is likely due to the comparative

remoteness of the most northeastern extremes of the country. Northern Canada as a whole contains a rather diverse combination of mining operations, including those of base metals, precious metals, oil, gas, and iron ore.

Though no CMAs exist in the Northern Canada region, the lowest values of mining employment proportion by CSD tend to occur in the most ‘built-up’ towns and cities of the region. This is probably indicative of more diversified economies existing in a region of otherwise comparative isolation. Whitehorse (0.94%), Hay River (0.53%), Inuvik (0.57%), Iqualuit (0.3%), and Rankin Inlet (0.97%) are the only CSDs to retain values of mining employment proportion consistent with the ‘low’ category. Each of these CSDs occurred in cities with populations with no fewer than 2,000 persons (Government of Canada 2017)

Kitikmeot CSD (86.67%) in Nunavut has the highest proportion of mining employment of any CSD in the entire nationwide study. Kitikmeot CSD contains operations in gold and iron ore mining (Natural Resources Canada Government of Canada 2016).

4.6 Socioeconomic Variances

Overall, the ‘low’ and ‘’extreme’ categories show the highest values of variance against the ‘overall’ category, used as the basis for comparison in this study. Communities corresponding with either these categories tend to experience a higher proportion of foreign-born residents, post-secondary education level, a higher median income, and a lower unemployment rate. Mean house value in the ‘low’ category ($179,451) is significantly higher than that of the ‘extreme’ category ($74,802), but this is believed to be heavily influenced by CSDs in the ‘extreme’ category tending to be

distributed in unique and peripheral locations throughout Canada. Comparatively much, of the ‘low’ category CSDs fall into expensive metropolitan and well-developed areas associated with higher property values. Another exception in similarities lays in population change, wherein ‘low’ shows the most growth (3.79%), while ‘extreme’ shows the most decline (-0.92%). Median age shows no significant variance across all of the mining proportion CSDs.

The ‘none’ category values are quite consistent with the ‘overall’ category. The exception is Median House Value, which has a variance of $10,162, with ‘overall’ having the higher Median House Value ($99,887).

‘Low’ mining employment CSDs have the highest incidence of foreign-born residents (10.66%) in the study, the highest proportion of post-secondary educated residents (30.59%), the highest median population growth (3.79%), the highest median house value in the study ($179,451) and the second-lowest median unemployment rate in the study (4.89%). In terms of housing, ‘low’ category mining communities retain the least affordable housing with regards to median income vs median house value ratio. See figure 2.

‘Moderate’ mining employment CSDs retain a relatively high proportion of foreign-born residents (6.43%), the highest levels of unemployment in the country (6.03%), modest population growth (0.18%), and significantly higher property values compared to the ‘overall’ median ($125,124).

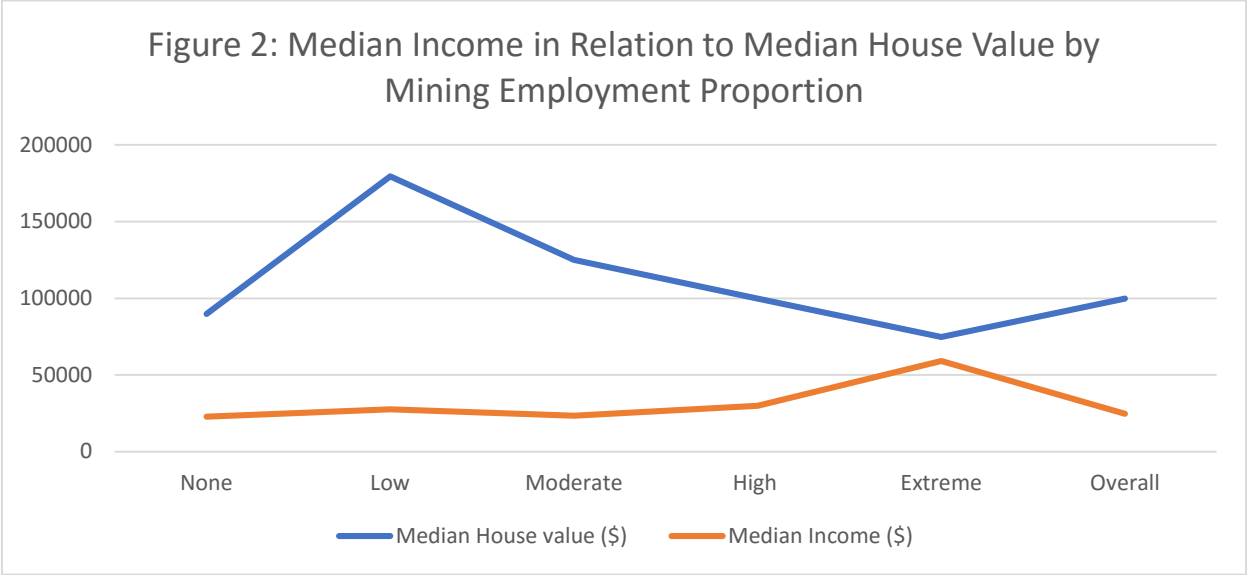
The ‘high’ category has the lowest proportion of foreign-born residents (3.96%), the second-most significant population decline (-0.49%), and relatively modest median income ($29,986).

‘Extreme’ mining proportions CSD show the lowest unemployment values (3.13%) in the study, the most significant population decline (-0.92%), the lowest median house value ($74,802), and the highest median income ($59,116). The relationship between median income and median house value was deemed especially significant, given that this ratio makes ‘extreme’ category mining CSDs the most affordable community category in terms of housing affordability. See Table 2 and Figure 2.

Table 2: Socioeconomic Variables According to Mining Employment Proportion:

Mining Employment CSDs	**Foreign-born %**	**Post-secondary Education %**	**Unemployment %**	**Population Change (2006-2001) %**	**Median House value ($)**	**Median Income ($)**	**Median Age**
None	4.49	21.05	5.79	-0.67	89, 725	22,817	43.0
Low	10.66	30.59	4.89	3.79	179,451	27,591	41.1
Moderate	6.43	24.23	6.03	0.18	125,124	23,492	41.8
High	3.96	22.78	5.26	-0.49	99,899	29,986	41.1
Extreme	5.81	22.58	3.13	-0.92	74,802	59,116	42.8
Overall	5.26	22.48	5.56	0	99,887	24,640	42.6

Figure 2:



5.0 Conclusion

This study examined the spatial distribution of mining employment through proportion of mining employment according to census subdivisions, and how these varying employment proportions may have a generalized impact on various socioeconomic variables. Through use of GIS, Canadian regions were able to be analyzed separately and reviewed for findings. A table was constructed displaying the medians of seven socioeconomic factors compared against categorical stratifications of mining employment (none, low, moderate, high, extreme, overall). Overall, a number of intriguing results were reached. Principally, that much of Canada's mining employment occurs within large metropolitan areas (CMAs) of Canada. This is an observation at odds with what perhaps many view as a profession associated with more peripheral and northern regions, far away from the generally urban population that constitutes the

population stronghold of southern Canada. This suggests that mining is more integral to the urban economy and social profile of the country than traditional stereotypes may suggest. This is further corroborated by the incidence of the ‘extreme’ category CSDs. Half of which were located in southern portions of the country, with many still situated nearby, adjacent to, or even within some of Canada’s CMAs. In fact, several CMAs retain a significant amount of ‘high’ and ‘moderate’ category mining employment.

When compared to all other provinces and territories, there appears to be significant clustering of mining employment within Alberta and Ontario. This trend remains consistent in Southern Ontario, though with lower proportional values.

When socioeconomic variables are compared to mining-employment proportion, communities showing the most affluence and ‘positive’ values of socioeconomic conditions tend to belong either to the ‘low’ or ‘extreme’ stratifications of mining employment proportion. This indicates that balanced and diverse economies typically associated with the ‘healthiest’ communities are also common to locations with very high emphasis on mining-related employment. Given that the extraction and processing of Earth materials is lucrative, significant wealth is passed on to mining employees who constitute a substantial proportion of the population of ‘extreme’ category CSDs. The evidence for this is suggested by socioeconomic levels common to ‘successful’ Canadian communities exhibiting low unemployment, exceptionally affordable housing, high income, and a relatively diverse and educated population. The most significant deviations between the ‘low’ and ‘extreme’ categories are a lower proportion of foreign-born residents (5.81% vs 10.66%), and population decline (-0.92 vs 3.79).

The intermediary mining-employment categories reveal much more variation, with some socioeconomic variables showing uneven trends. For example, ‘moderate’ mining communities are below the national median income level and have high median house values, but are among the most college-educated populations. The ‘high’ mining communities have a relatively high population decline, but are among the highest in median income values.

Another key finding is that, overall, communities with no mining activity whatsoever exhibit the least ‘healthy’ values of socioeconomic variables. Communities with no mining employment are less diverse, less college-educated, and have a lower median income than the national median. They also face population decline whereas the national median for population change is 0. Foreign-born (4.49%), post-secondary education (21.05%), and median income ($22,817) among the ‘none’ category register the lowest, and median age (43.0) highest for the entire study. Therefore, ‘none’ category communities are arguably the least sustainable and prosperous in Canada. In fact, the study in summation suggests that mining activity may be one of the most important determining factors in overall Canadian affluence. In light of these findings, it can be stated that Canadian communities rely heavily on natural resource-based wealth employment. As such, further diversification outside the realm of resource extraction may prove critical to the maintenance of the Canadian economy as resources and resource-based communities face depletion into the future.

In light of these conclusions, some limitations to this study have been identified. The census data used to illustrate mining employment distribution throughout Canada and to compute median values for socioeconomic variables were obtained from the

2006 Canadian census program. In the interest of relevance, further research could benefit from more recent datasets as they become available. Furthermore, the study is focused on quantitative data, and much of the literature examined indicates that the ‘social fabric’ of various resource-dependent communities is heavily nuanced and dependent on qualitative research aspects, something which was beyond the scope of this study. Additionally, other indicators of mining-related employment levels may be used to better understand the dependency of mining among Canada’s municipalities, such as taking into account proportion of employment in related mining ‘spin-off’ industries at the CSD level.

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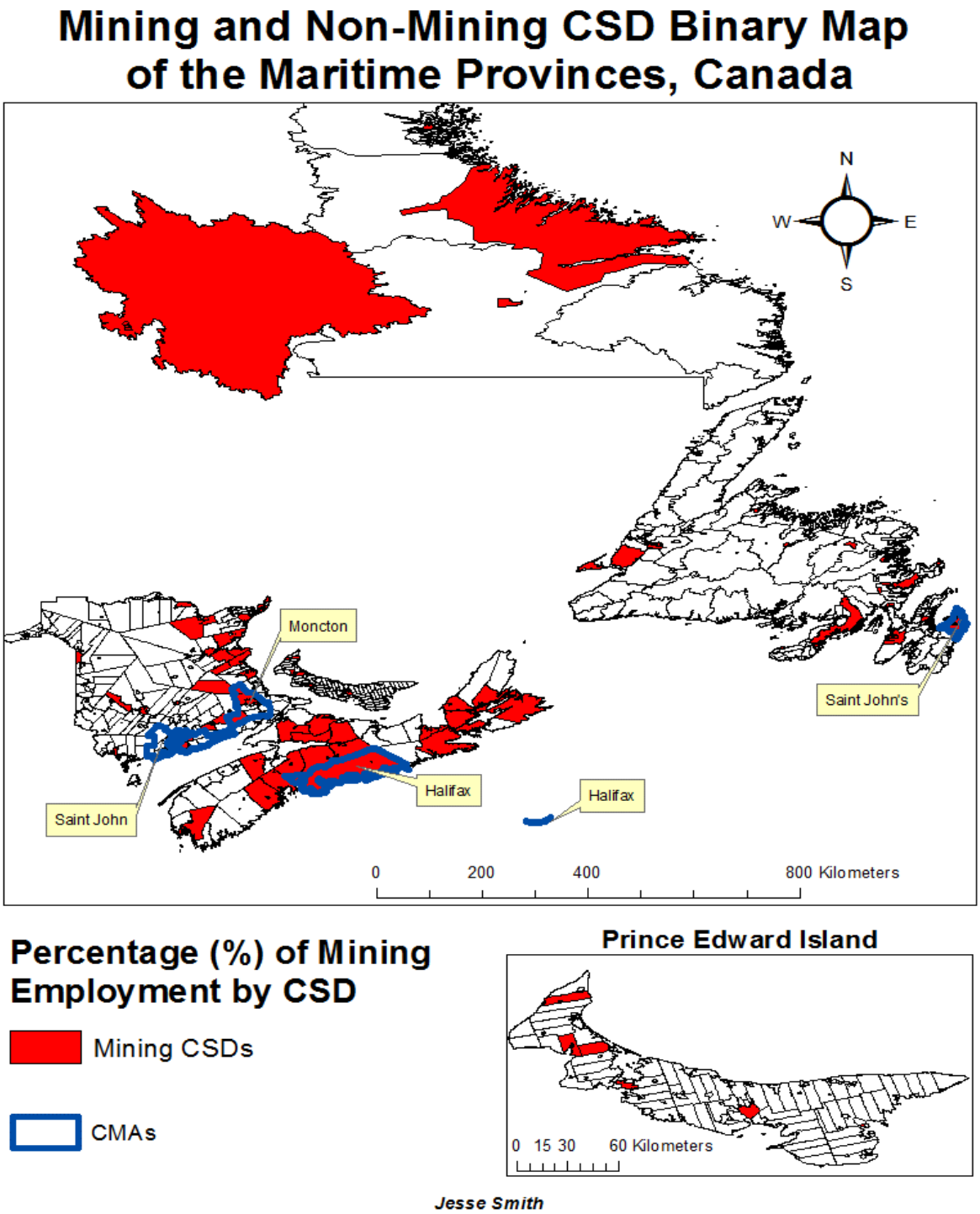
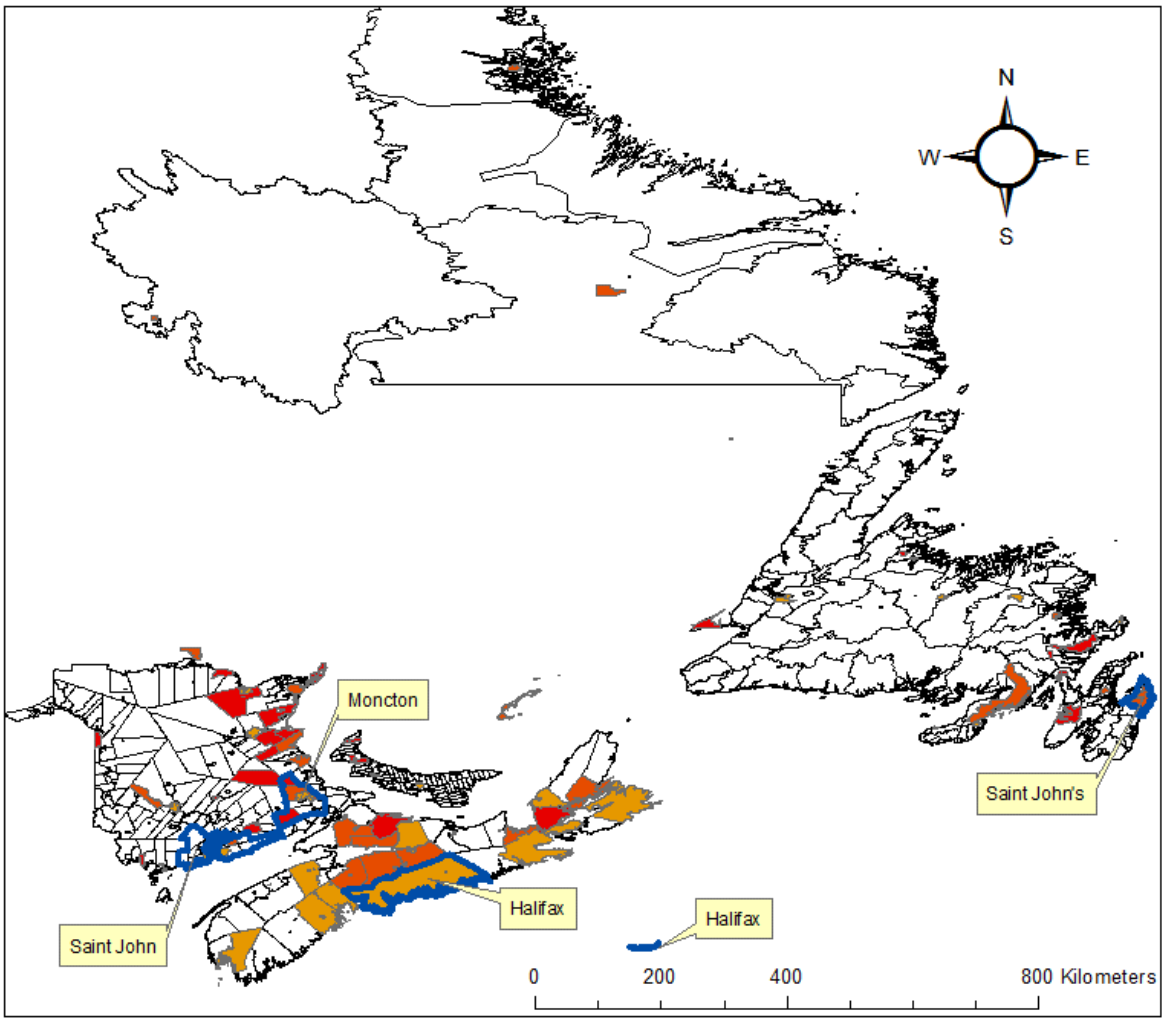
Appendix of Maps

4.1 The Maritime Provinces



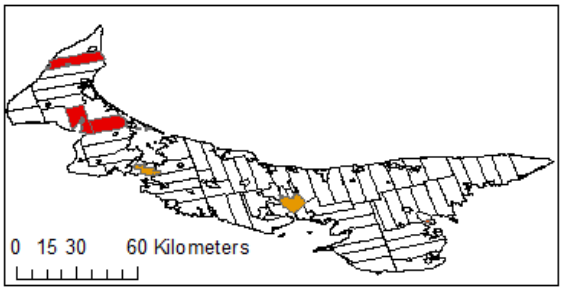
'Medium' Range Mining CSD Map of the Maritime Provinces, Canada



Percentage (%) of Mining Employment by CSD

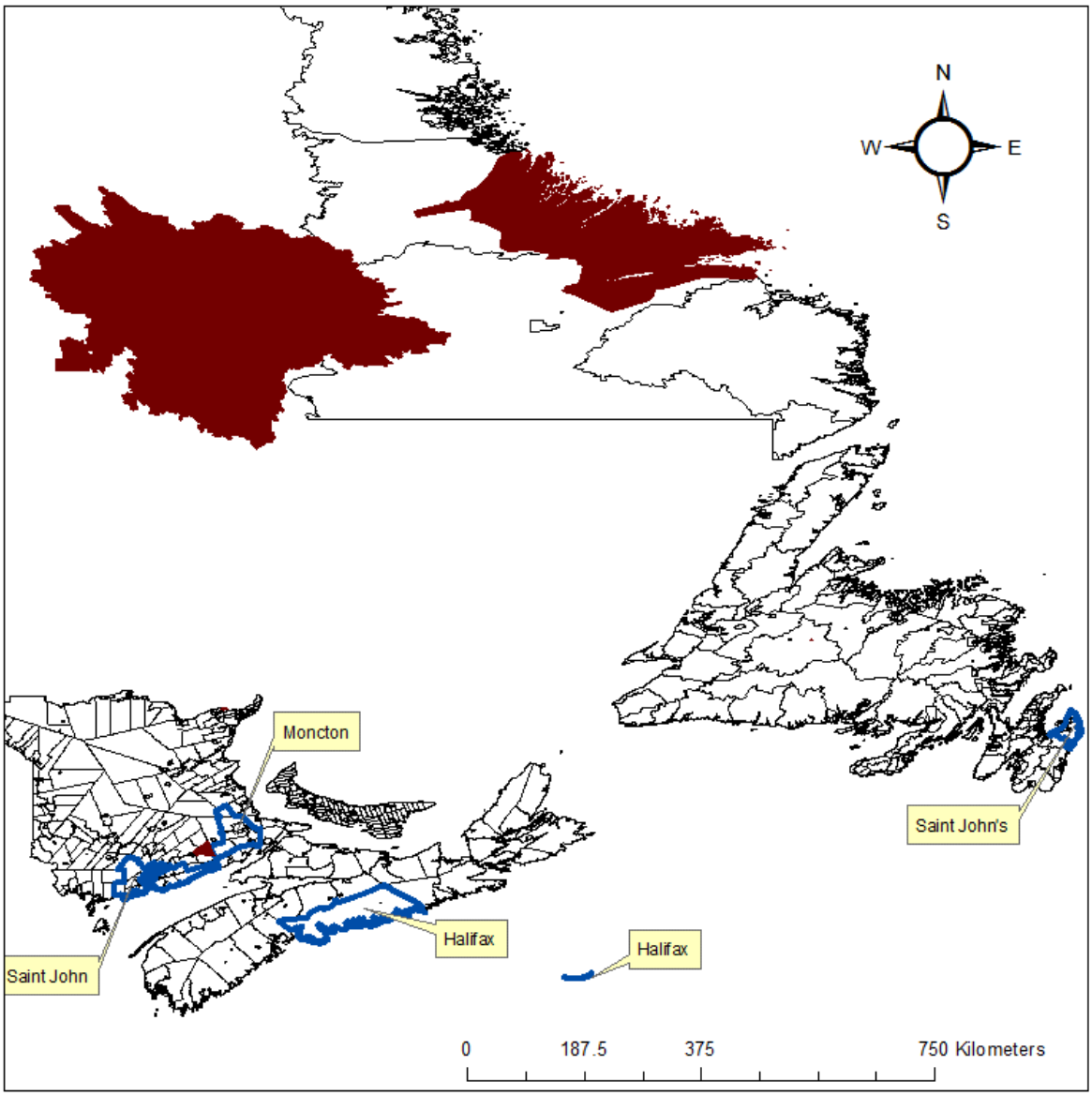
- 0.06 - 1.15
- 1.16 - 6.45
- 6.46 - 39.47
- CMAs

Prince Edward Island



Jesse Smith

'Extreme High' Range Mining CSD Map of the Maritime Provinces, Canada



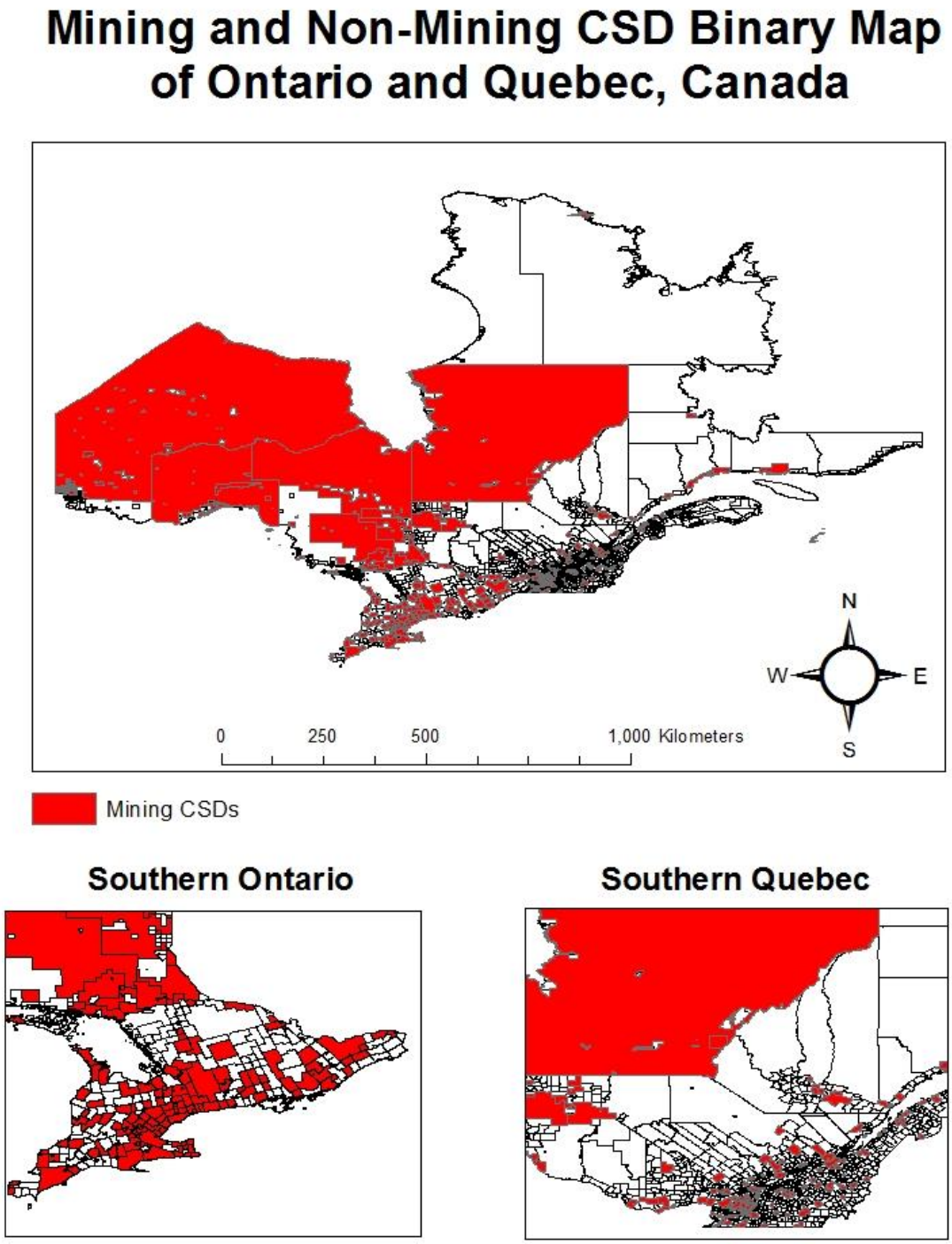
Percentage (%) of Mining Employment by CSD

42.35 - 86.67

CMAs

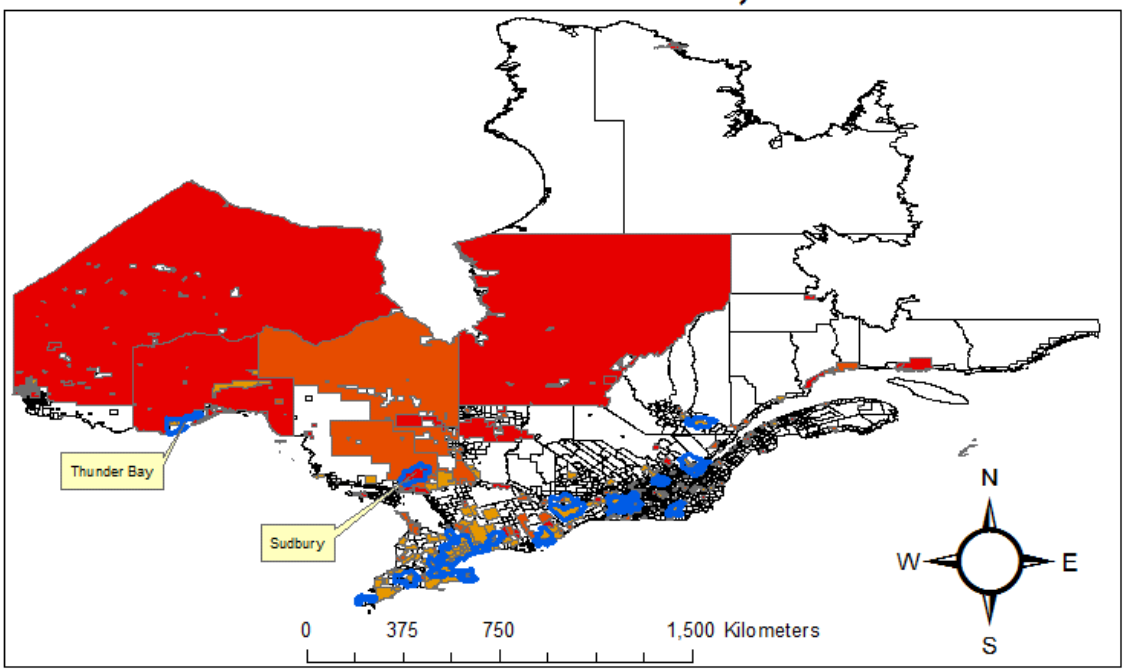
Jesse Smith

4.2 Central Canada

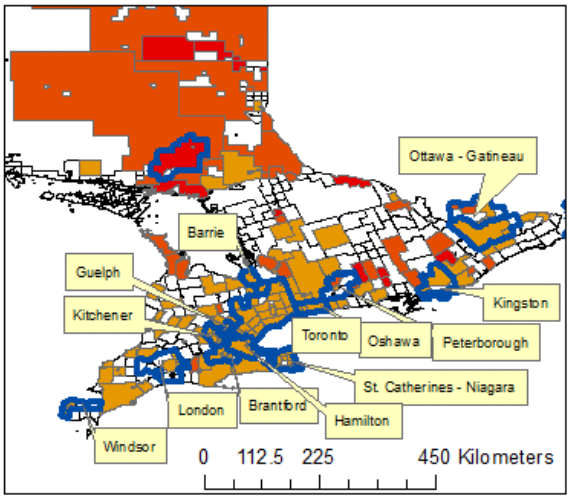


Jese Smith

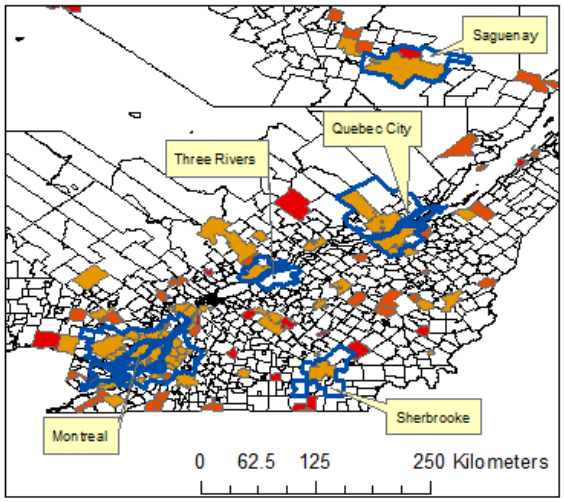
'Medium' Range Mining CSD Map of Ontario and Quebec, Canada



Southern Ontario



Southern Quebec



Percentage (%) of Mining Employment by CSD

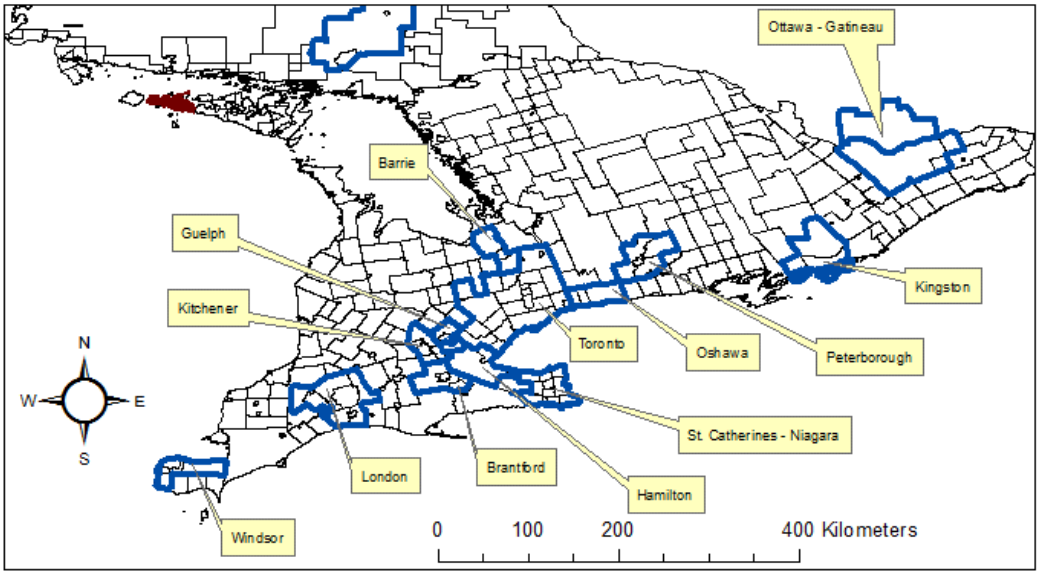
- 0.02 - 1.15
- 1.16 - 6.45
- 6.46 - 39.47

CMAs

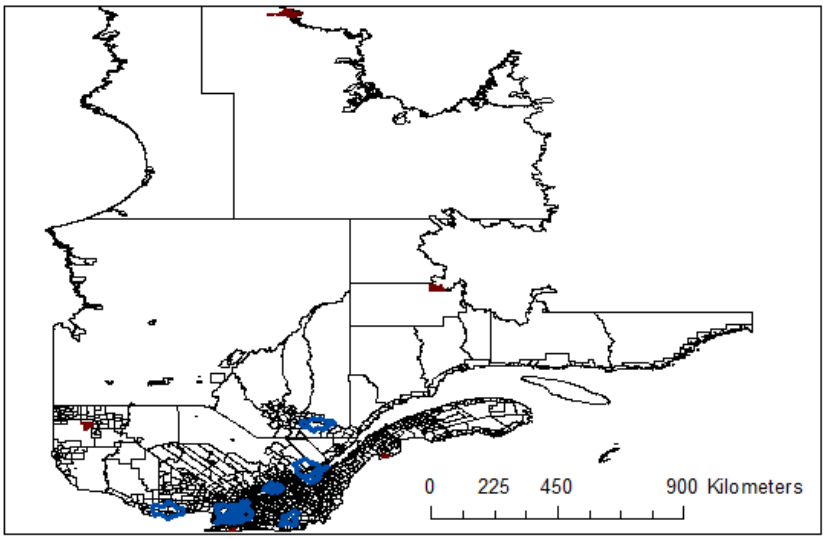
Jese Smith

'Extreme High' Range Mining CSD Maps of Ontario and Quebec, Canada

Southern Ontario



Quebec



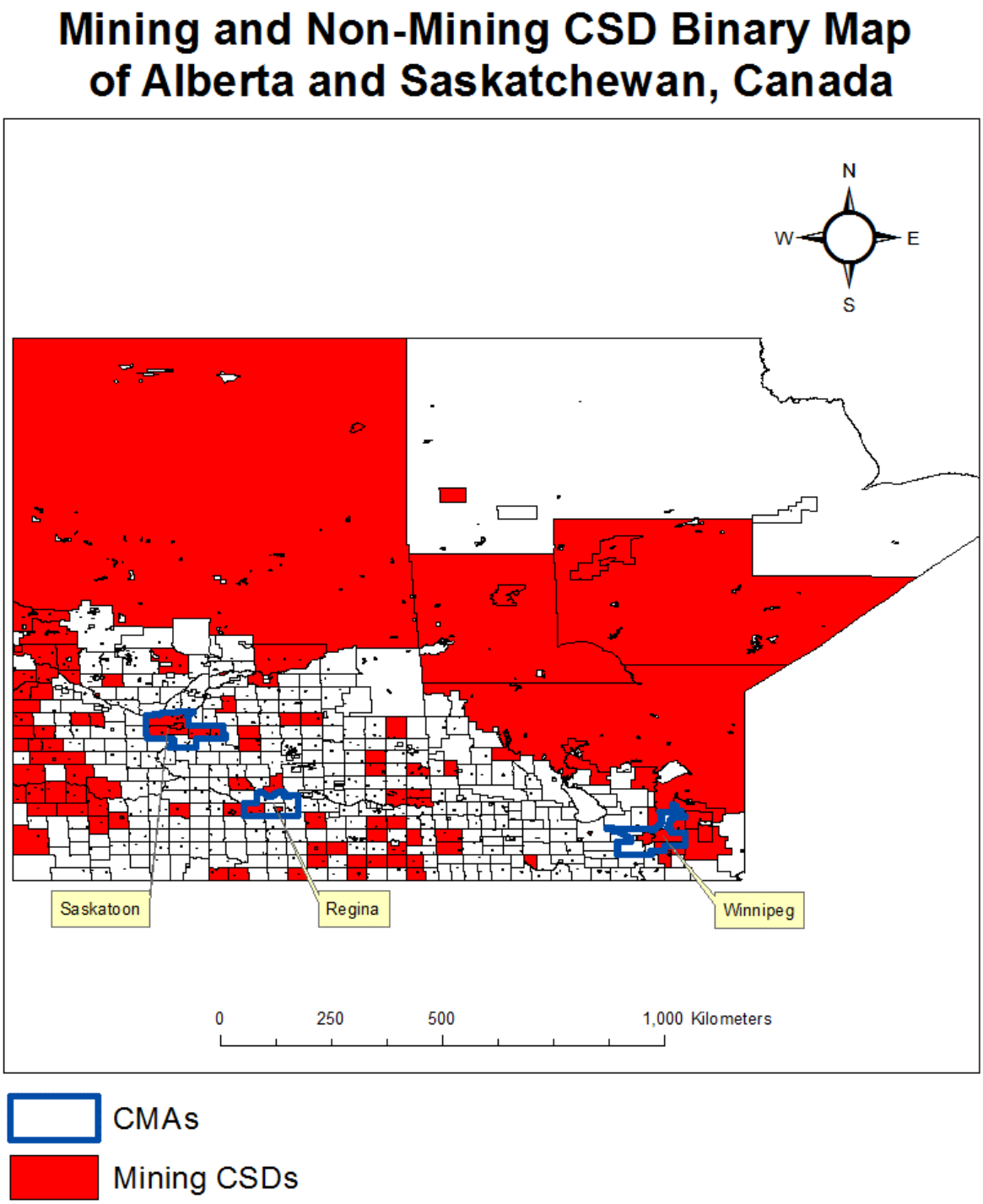
Percentage (%) of Mining Employment by CSD

44.44 - 86.67

CMAs

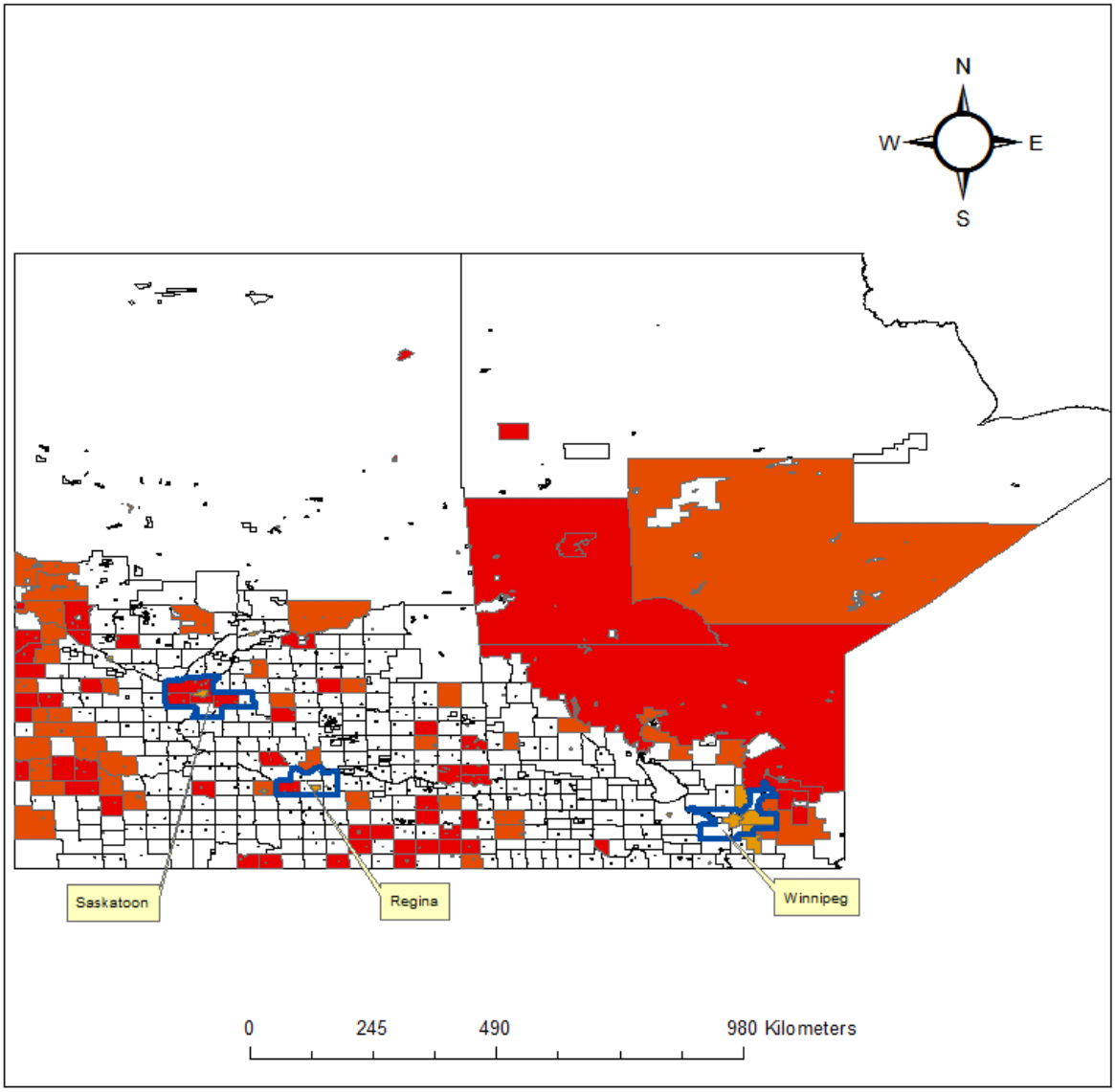
Jese Smith

4.3 Prairies Region



Jesse Smith

'Medium' Range Mining CSD Map of Manitoba and Saskatchewan



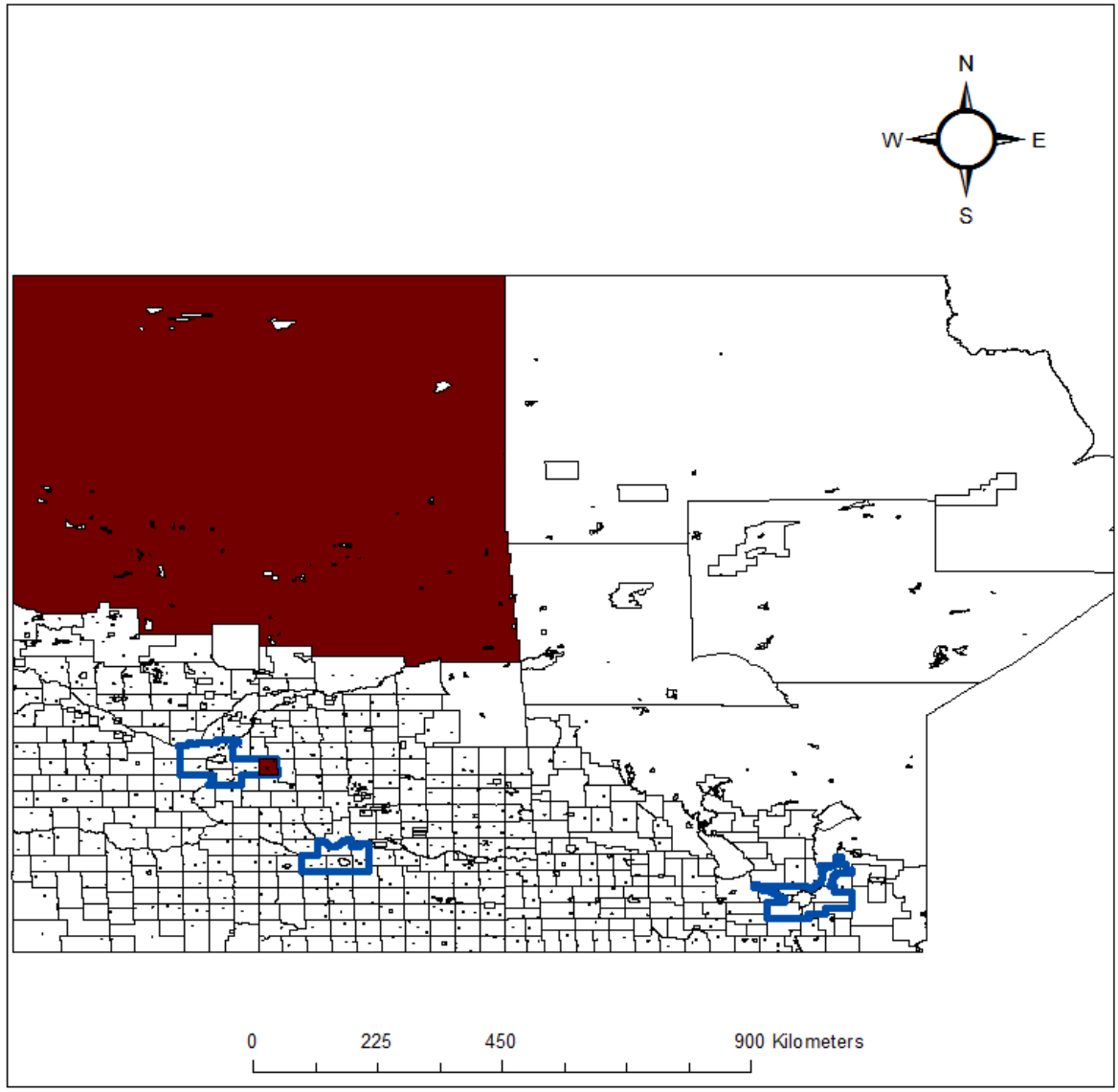
Percentage (%) Of Mining Employment by CSD

- 0.05 - 1.15
- 1.16 - 6.45
- 6.46 - 39.47

CMAs

Jesse Smith

'Extreme High' Range Mining CSD Map of Manitoba and Saskatchewan



Percentage (%) Of Mining Employment by CSD

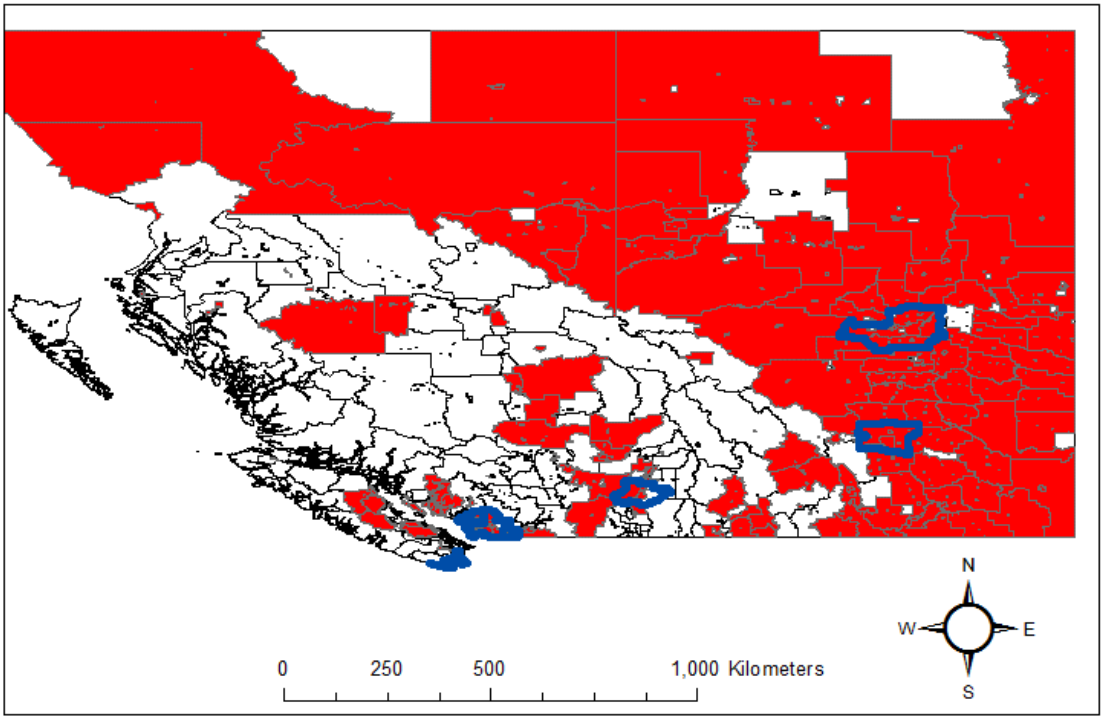
43.28 - 86.67

CMAs

Jesse Smith

4.4 Far-Western Canada

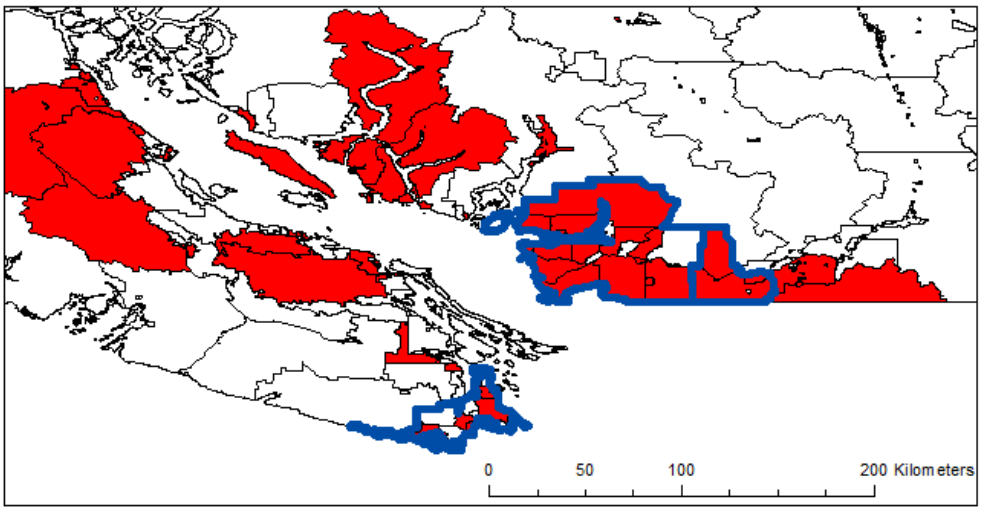
Mining and Non-Mining CSD Binary Map of British Columbia and Alberta, Canada



CMAs

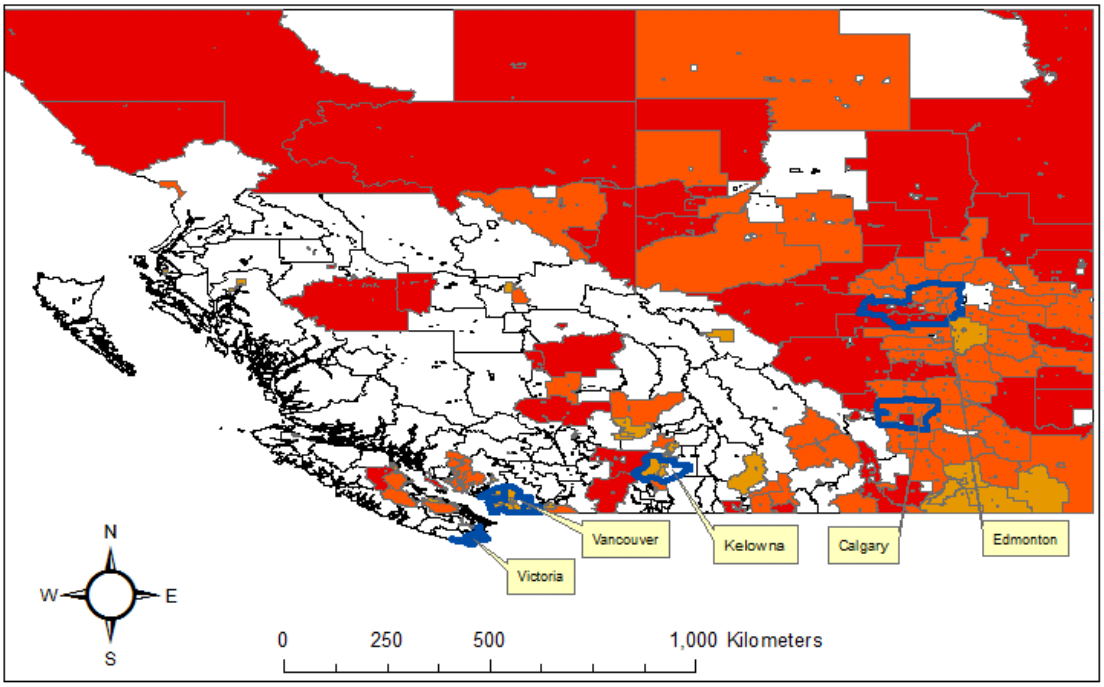
Mining CSDs

Southern BC

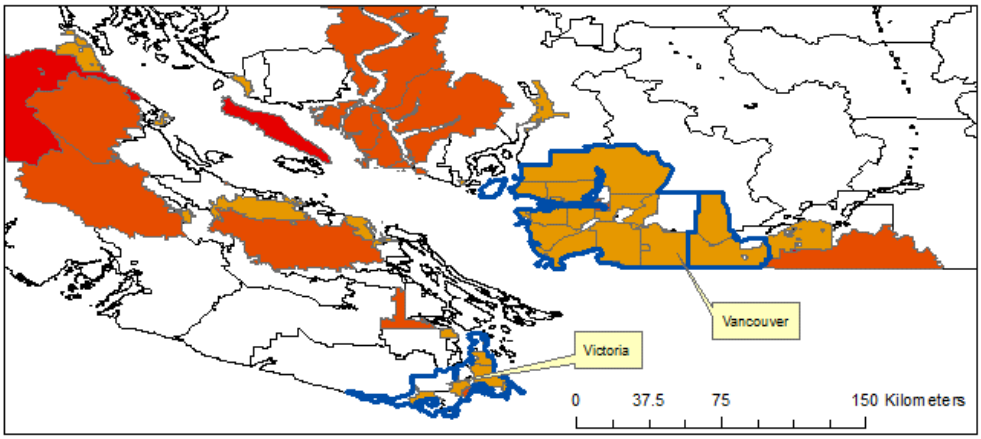


Jese Smith

'Medium' Range Mining CSD Map of British Columbia and Alberta



Southern BC



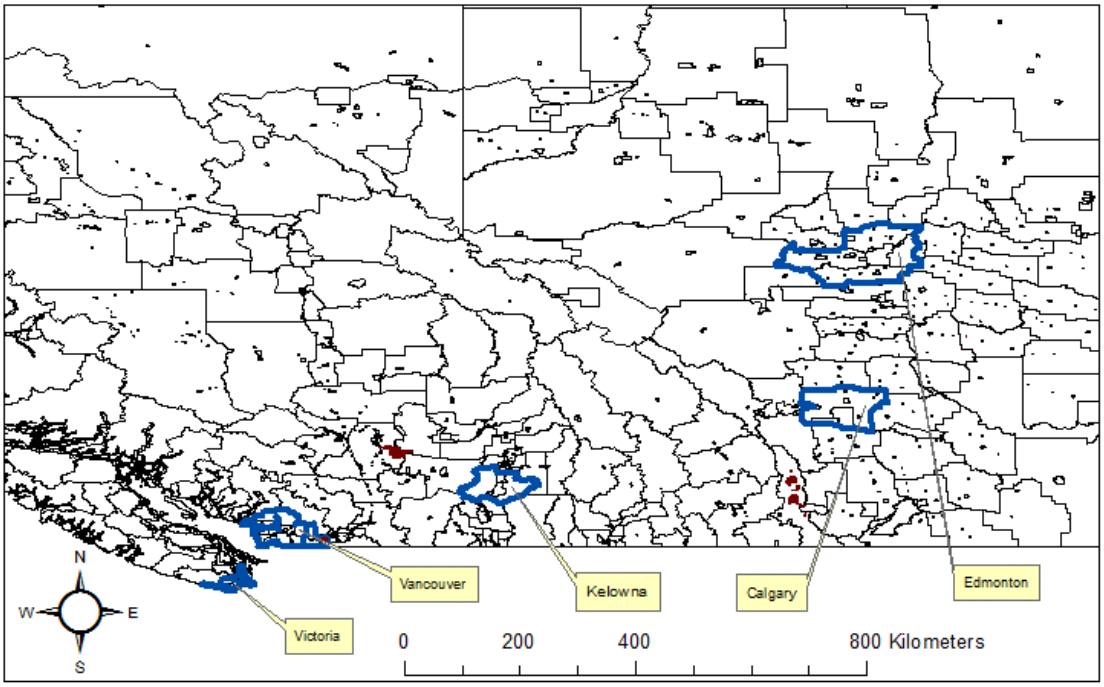
Perecentage (%) of Mining Employment CSD

- 0.02 - 1.15
- 1.16 - 6.45
- 6.46 - 39.47

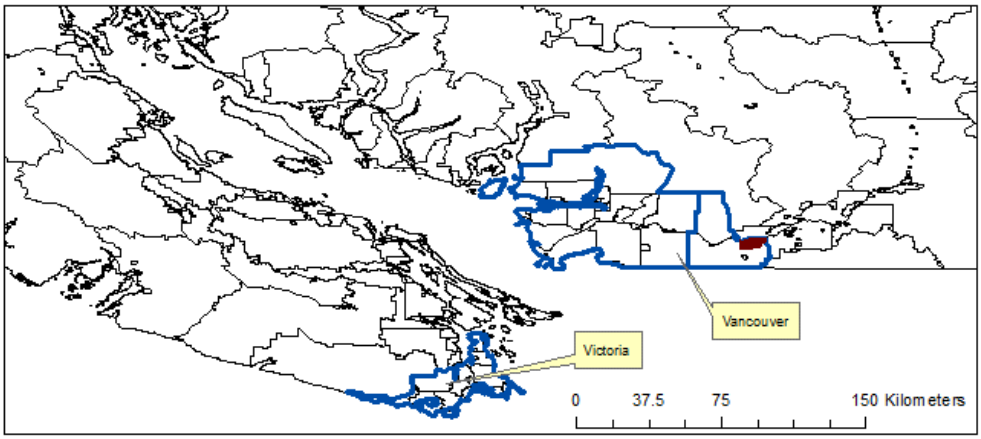
CMAs

Jese Smith

'Extreme High' Range Mining CSD Map of British Columbia and Alberta



Southern BC



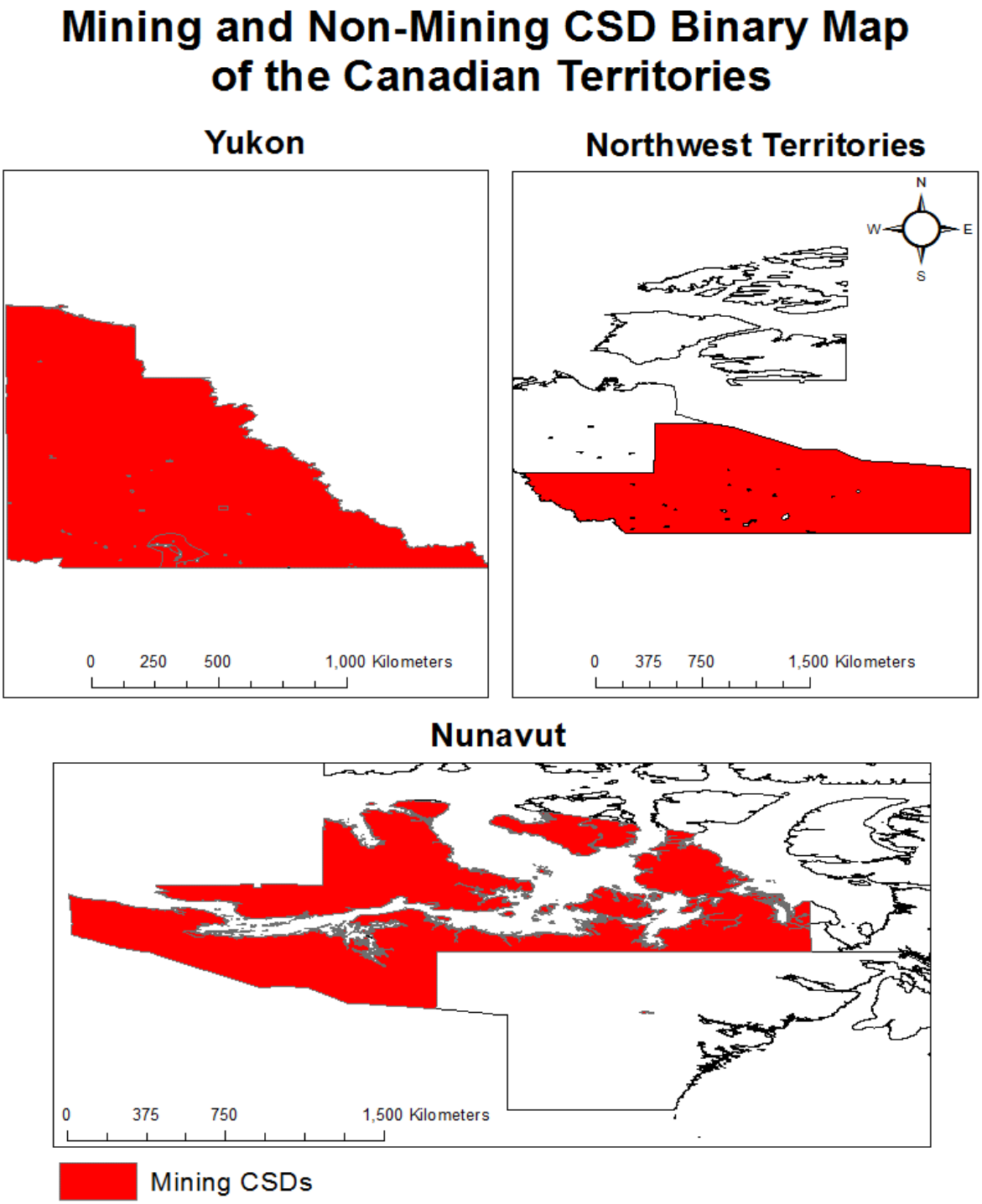
Perecentage (%) of Mining Employment CSD

CMAs

42.35 - 86.67

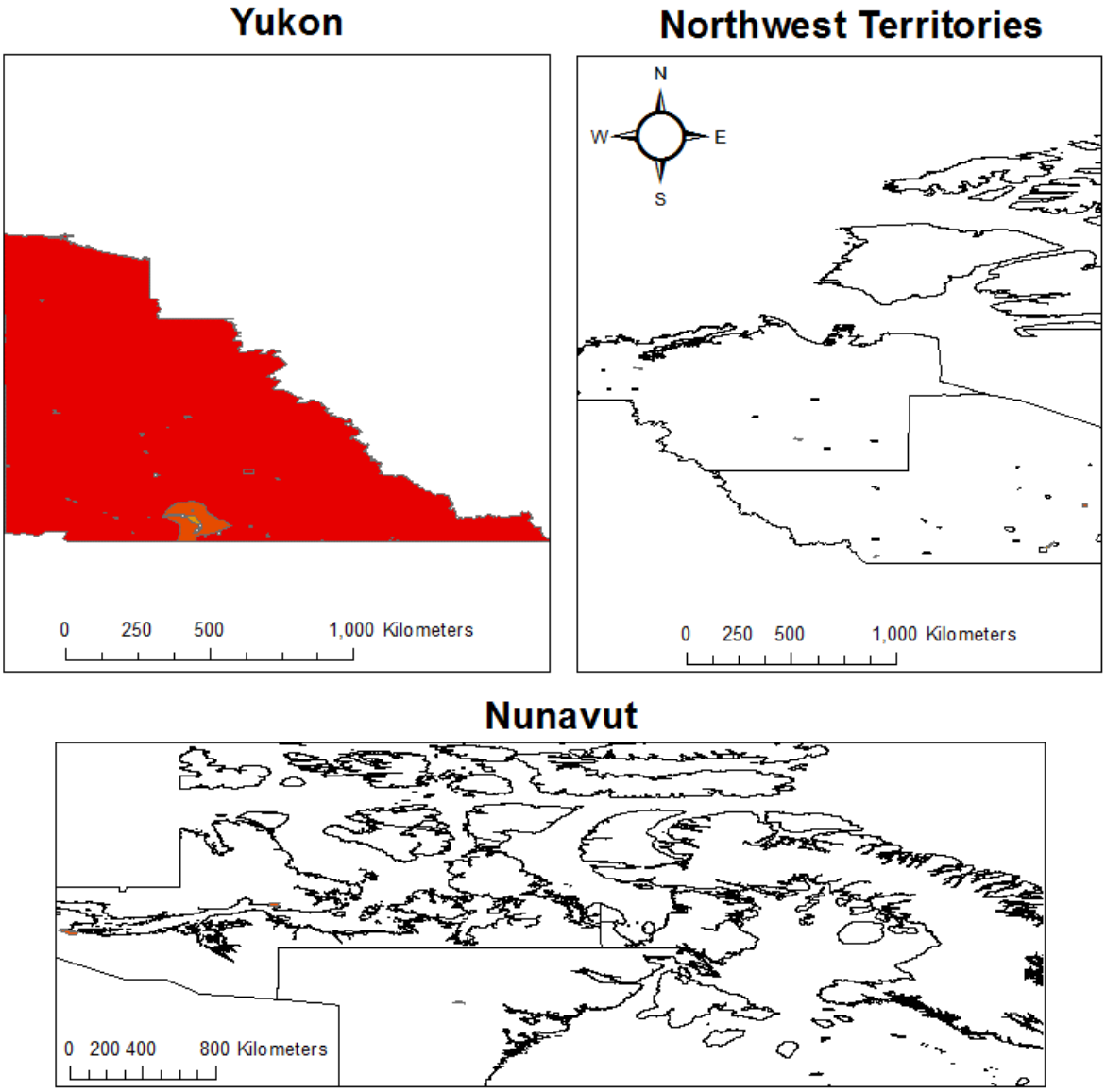
Jese Smith

4.5 Northern Canada



Jesse Smith

'Medium' Range Mining CSD Map of the Canadian Territories



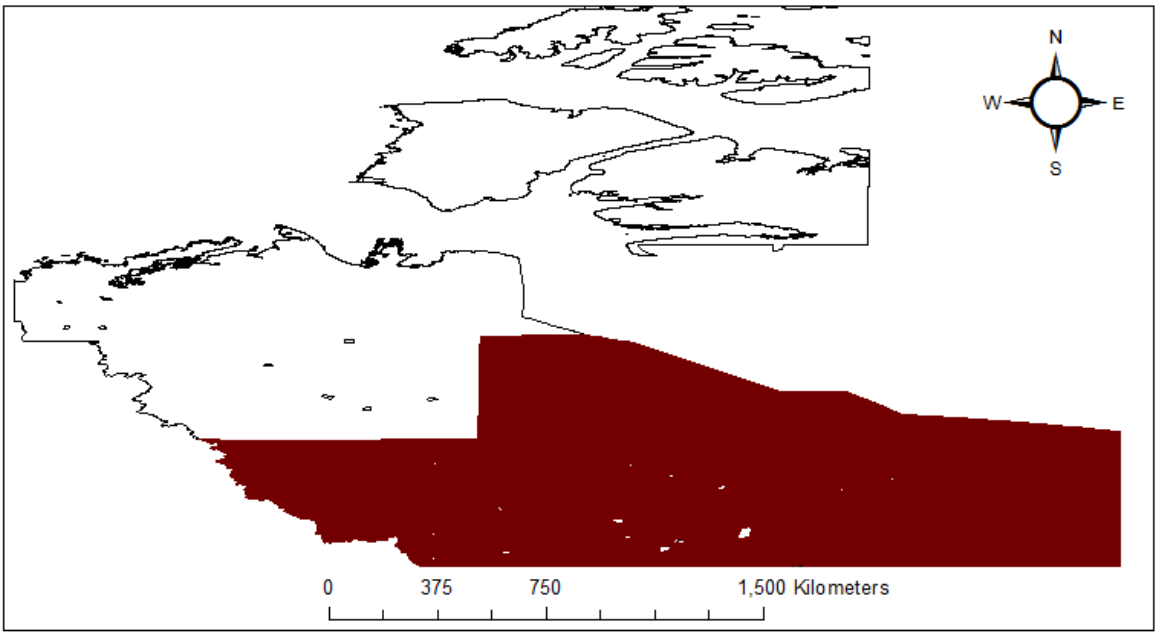
Percentage (%) of Mining Employment by CSD

- 0.30 - 1.15
- 1.16 - 6.45
- 6.46 - 39.47

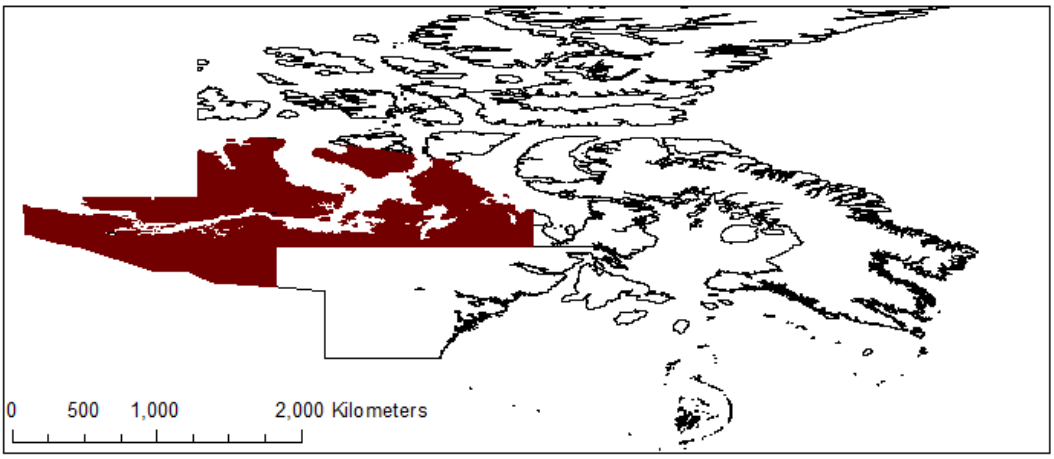
Jesse Smith

'Extreme High' Range Mining CSD Map of the Canadian Territories

Northwest Territories



Nunavut



Percentage (%) of Mining Employment by CSD

71.30 - 86.67

Jesse Smith